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Mammography use for breast cancer screening in Portugal: results from the 2005/2006 National Health Survey

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Background: Understanding the patterns of mammography use is essential to promote the participation in breast cancer screening. **Objectives:** To describe the patterns of screening mammography use in Portugal. **Methods:** As part of the fourth National Health Survey (2005/2006), 3045 women were evaluated in face-to-face interviews. The previous use of mammography for screening was classified as never or ever, and the latter was further grouped according to the time elapsed since the latest mammography. Having undergone the latest mammography >2 years before was considered underuse. We assessed the determinants of never having been screened by mammography and, among those who had been tested, the determinants of mammography underuse, through age- and education-adjusted odds ratios (ORs), with 95% confidence intervals (95% CIs). **Results:** Among women aged 45–49 and 50–69 years, 86.3% and 88.0%, respectively, underwent a screening mammography before, and most of them were tested in the previous 2 years. The lowest risk of never having been screened was in Norte (OR = 0.41, 95% CI: 0.21–0.80) and the highest in Açores (OR = 4.04, 95% CI: 2.37–6.92), in comparison with Centro (the region with organized screening for a longer time). Participants with <4 years of formal education were more likely to have never been screened than the more educated (OR = 4.27, 95% CI: 1.67–10.89). Women with private health insurance (OR = 0.16, 95% CI: 0.04–0.65), as well as those who had undergone cervical cytology screening before (OR = 0.50, 95% CI: 0.30–0.85), had a lower risk of underuse. **Conclusions:** This study provides useful information to improve the allocation of resources to breast cancer screening.

Introduction

Breast cancer accounted for 22.9% of all cancers and 13.7% of all deaths in 2008.[1] In Europe, the median decrease in breast cancer mortality between 1989 and 2006 was 19%, which is partially attributable to a growing use of effective control measures such as early detection by mammography.[2,3]

The European Council[4] currently recommends the screening of women aged 50–69 years through high-quality mammography screening programmes. Organized mammographic screening is considered an essential public health tool to reduce breast cancer morbidity and mortality and to improve the quality of life of patients,[3,5] as well as to reduce inequalities in the access to early detection. However, in many European countries, only opportunistic screening is available or it coexists with organized programmes.[6] Specifically in Portugal, organized breast cancer screening targeting women aged 45–69 years was initially set up in the region of Centro in 1990,[7] having attained full geographical coverage in 2001. Organized breast cancer screening was expanded to the remaining of the country territory, though complete coverage was not achieved yet.[6,8]

The extent to which women undergo mammography screening depends on the existence of organized programmes and on how they are functioning, the access to health-care services and the knowledge and social representations about screening in different population subgroups. Therefore, understanding the patterns of mammographic screening use is essential to improve the national health policy for cancer screening, both regarding the promotion of the participation in the existing programmes and for an effective transition from opportunistic to organized screening.[9,10]

This study aimed to describe the use of mammography for breast cancer screening by Portuguese women and to identify the determinants of its non-use or underuse in this setting, using data from the fourth National Health Survey (IV-NHS), conducted in 2005/2006.

Methods

Characteristics of the study sample and questionnaire evaluation

The IV-NHS is a community-based cross-sectional study that evaluated a sample of the Portuguese population, representative at the national and regional (NUTS II—Territorial Nomenclature Units for Statistical Purposes, level II) levels, obtained through complex stratified and cluster sampling. People living in collective residential institutions at the time of recruitment (e.g. hotels, hospitals and military facilities) were not eligible. A sample of households was defined, using data from the 2001 Population and Housing Census, to be used as the sampling frame for household surveys conducted by the National Institute of Statistics (INE). It included 1408 geographical units with at least 240 households each, selected systematically within larger geographical strata, with a probability proportional to the number of households in each unit. A random sample of the households (secondary sampling units) was selected, and all subjects living in these households were eligible. The sample size was defined to ensure a homogeneous distribution of the participants

by the seven NUTS II regions [Norte, Centro, Lisboa e Vale do Tejo (LVT), Alentejo, Algarve, Região Autónoma da Madeira and Região Autónoma dos Açores], and a coefficient of variation not exceeding 15% for subsamples with at least 5% of the population of any of the regions.

Between February 2005 and January 2006, trained interviewers evaluated 41 193 subjects, from 15 239 households, through computer-assisted personal interviews. This corresponded to a participation of 76% of the selected households. Interviews could not be accomplished in ~7% of dwellings that were not inhabited and in 5% because of refusals to participate.

In addition to the socio-demographic characterization, the questionnaire covered 17 thematic areas. The questions referring to six of these areas were applied only in one of the four trimesters, to ensure that the average duration of the interviews did not exceed 75 min/household. It included questions that were used to obtain information from all participants (either directly or from a proxy respondent), whereas some of them could not be answered by a proxy.

The question referring to mammography testing was included in the section that refers to 'preventive care', and was applied only to women aged ≥20 years, between the 27th and 39th week of data collection and had to be answered directly (no proxy responses were allowed). Therefore, 3386 participants were eligible, and information on mammography testing was available for 3373 women. The present analyses were conducted among women aged above 29 years (n = 3045).

Women were inquired about the timing of their most recent mammography, by asking 'in which year did you have your most recent mammography, that is, a chest radiography?'. This question was preceded by an introduction referring to preventive care as follows: 'Now I would like to make you some brief questions about people's actions to prevent diseases'.

The IV-NHS database includes sampling weights to be used in data analysis, for the estimates to be representative of the Portuguese population. These were computed based on the inverse of the probability of selection of each sampling unit and further corrected for non-responses and for the effective number of subjects evaluated.

Definition of the main variables and methods used for statistical analysis

The previous use of mammography for screening was classified as never or ever, and the latter group was further divided according to the time elapsed since the date of the latest mammography testing: up to 2 years, 3–5 years and > 5 years. The latter two categories were classified as underuse.

Regarding age, the participants were grouped in five categories: 30–39, 40–44, 45–49, 50–69 and ≥ 70 years. These were defined taking into account the European guidelines for breast cancer screening (50–69 years)[4] and the screening policy adopted in Portugal (45–69 years).[11]

We computed the prevalences of screening mammography use in different age-groups and used non-conditional logistic regression to estimate the relation between socio-demographic characteristics, access and use of health-care services and risk factors for chronic diseases (smoking and overweight) and the use of mammography as part of preventive care. We further assessed the determinants of underuse among the women who had been tested before.

All analyses were conducted using the sampling weights, using STATA® version 11.2.

Results

Characteristics of the study sample

Nearly 50% of the population was aged 45–69 years and therefore potentially eligible for breast cancer screening. Twenty-one percent of the women had <4 years of schooling and just over one-tenth had college education. Nearly 18% of the women had access to public health care through a National Health Service subsystem, and 7.8% had a private health insurance (table 1).

Mammography use for breast cancer screening

The overall proportion of women having undergone a screening mammography at least once was 69.4% [95% confidence interval (95% CI): 66.9–71.8]. The highest life prevalences were observed among women aged 50–69 years (88.0%) and 45–49 years (86.3%). In the age-group 40–44 years, the prevalence was slightly lower (77.5%), and 41.9% of the younger women reported a previous screening mammography. Most of the women aged

Table 1 Characteristics of the study sample ($n = 3045$)

	N	Unweighted (%)	Weighted (%)
Region of residence (NUTS II)			
Norte	458	15.0	33.2
Centro	488	16.0	17.2
LVT	408	13.4	36.5
Alentejo	446	14.7	5.2
Algarve	455	15.0	4.0
R.A. Açores	403	13.2	1.8
R.A. Madeira	387	12.7	2.1
Age (years)			
30–39	519	17.0	22.1
40–44	310	10.2	10.5
45–49	329	10.8	9.6
50–69	1154	37.9	35.6
≥70	733	24.1	22.2
Education (years)			
<4	688	22.6	20.7
4–5	1255	41.2	37.7
6–8	333	10.9	11.4
9–11	284	9.3	10.3
12[a]	228	7.5	9.7
>12[b]	257	8.5	10.2
Marital status			
Single	278	9.1	9.2
Married[c]	2007	65.9	67.7
Divorced/separated	177	5.8	6.1
Widowed	583	19.2	17.0
Public health-care provider			
NHS	2505	82.3	82.5
NHS and other subsystem	539	17.7	17.5
Private health insurance			
No	2871	94.4	92.2
Yes	171	5.6	7.8
Doctor appointment (previous 3 months)			
No appointment	1126	37.0	34.8
Yes (routine)	295	9.7	9.1
Yes (due to a medical condition)	1624	53.3	56.1
Cervical cytology screening			
Never	1403	46.3	34.1
Yes (at least once)	1630	53.7	65.9
Smoking status			
Never smoker	2593	85.2	82.1
Ex-smoker	187	6.1	8.1
Current smoker	265	8.7	9.8
BMI (kg/m^2)			
<18.5	44	1.5	1.4
18.5–24.9	1211	40.5	42.7
25.0–29.9	1109	37.1	36.0
≥30	623	20.9	19.9

R.A., Região Autónoma (Autonomous Region); NHS, National Health Service; BMI, body mass index.
a: Also includes participants with >12 years of non-university education.
b: Includes all participants with university education.
c: Includes individuals who are legally married or cohabiting.

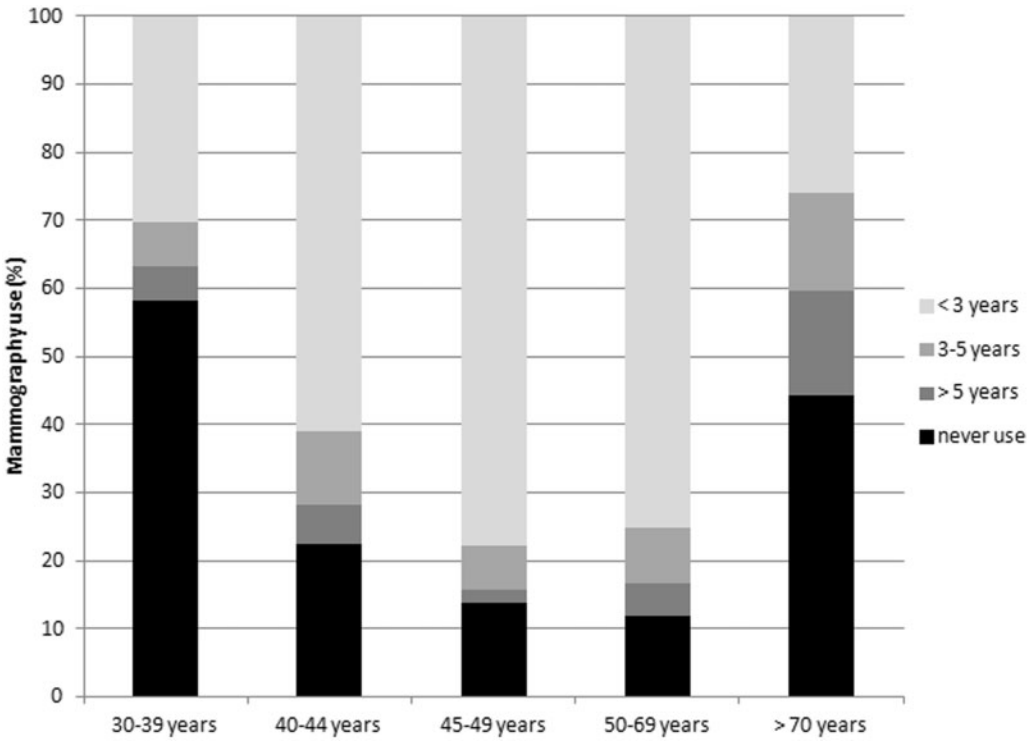

Figure 1 Prevalence of mammography use for breast cancer screening in Portugal, according to the elapsed time since the latest testing

30–69 years who had been screened reported the accomplishment of their latest mammography test <3 years before, ranging from 72.3% in the age-group 30–39 years to 90.2% among those aged 45–49 years. Among the older women (≥70 years), 55.7% reported having undergone a screening mammography, mostly > 2 years before (figure 1).

Determinants of having never undergone a screening mammography

Women aged 45–69 years

Compared with women living in the Centro region (the region with organized screening for a longer time), those from Algarve [odds ratio (OR) = 2.59, 95% CI: 1.51–4.42] and Açores (OR = 4.04, 95% CI: 2.37–6.92) were significantly more likely to have never undergone a screening mammography, whereas the opposite was observed for Norte (OR = 0.41, 95% CI: 0.21–0.80) and Alentejo (OR = 0.47, 95% CI: 0.24–0.93) dwellers.

No statistically significant differences were observed between women aged 45–49 years and those aged 50–69 years, or between subjects with different levels of education, except for the higher risk of never having undergone a mammography in the less educated women (<4 vs. >12 years, OR = 4.27, 95% CI: 1.67–10.89). Regarding marital status, married and divorced women were less likely to have never undergone a screening mammography (OR = 0.34, 95% CI: 0.16–0.76 and OR = 0.32, 95% CI: 0.10–0.99, respectively). No statistically significant differences in the use of mammography were observed between women according to the access to different public health-care providers or the possibility of benefiting from a private health insurance.

Women having had at least one routine doctor appointment in the previous 3 months and those who underwent cervical cytology screening before were 10 - and 20-fold less likely, respectively, of having never undergone a screening mammography.

No significant differences were observed according to smoking status, but obese women were less likely to having never undergone a mammography as part of preventive care (OR = 0.52, 95% CI: 0.29–0.92) (table 2).

Women aged ≥70 years

The relation between the socio-demographic variables and not having undergone a screening mammography was generally similar to that observed among the age-group 45–69 years, despite some differences in the point estimates and in the statistical significance of the associations, owing to the smaller number of women aged >70 years that contributes to a lower precision of the estimates. The same interpretation applies to the variables related to the use of health-care services.

However, in contrast with that observed among the age-group 45–69 years, smokers were less likely to have never undergone a screening mammography, and the opposite was observed for overweight/obese women, despite the associations were not statistically significant. For women with a body mass index of <18.5 kg/m^2, the OR was 6.68 (95% CI: 1.06–42.16) (table 2).

Women aged 30–44 years

In this age-group, when compared with the Centro dwellers, those from Alentejo (OR = 1.61, 95% CI: 0.77–3.37), Algarve (OR = 1.65, 95% CI: 0.87–3.14), Açores (OR = 2.79, 95% CI: 1.46–5.34) and Madeira (OR = 1.72, 95% CI: 0.83–3.55) were more likely to have never undergone a screening mammography. As observed for the other age-groups, women who had a recent doctor appointment and those who underwent a cervical cytology screening were less likely to have never undergone a mammography (table 2).

Determinants of screening mammography underuse

Women aged 45–69 years

No statistically significant associations were observed between the socio-demographic characteristics and underuse of screening mammography. However, the underuse tended to be more frequent in the regions of Algarve and Açores and less frequent in LVT, Alentejo and Madeira.

Women with a private health insurance were at a lower risk of screening mammography underuse (OR = 0.16, 95% CI: 0.04–0.65),

Table 2 Determinants of having never undergone a screening mammography

	Women who never underwent a screening mammography					
	Women aged 30–44		Women aged 45–69		Women aged ≥70	
	%	Adjusted[a] OR (95% CI)	%	Adjusted[a] OR (95% CI)	%	Adjusted[a] OR (95% CI)
Region of residence (NUTS II)						
Norte	43.8	0.89 (0.47–1.68)	8.6	0.41 (0.21–0.80)	43.2	0.55 (0.28–1.10)
Centro	46.2	1 (reference)	17.2	1 (reference)	55.6	1 (reference)
LVT	46.6	1.17 (0.62–2.19)	10.5	0.74 (0.39–1.42)	30.1	0.39 (0.19–0.78)
Alentejo	51.2	1.61 (0.77–3.37)	10.3	0.47 (0.24–0.93)	63.8	1.60 (0.84–3.05)
Algarve	53.7	1.65 (0.87–3.14)	27.8	2.59 (1.51–4.42)	70.5	2.21 (1.07–4.55)
R.A. Açores	65.8	2.79 (1.46–5.34)	38.8	4.04 (2.37–6.92)	71.4	2.30 (1.06–4.96)
R.A. Madeira	58.4	1.72 (0.83–3.55)	16.7	1.10 (0.60–2.04)	53.1	1.00 (0.51–1.97)
Age (years)						
30–39	58.1	1 (reference)	–	–	–	–
40–44	22.5	0.12 (0.08–0.19)	–	–	–	–
45–49	–	–	13.7	1.60 (0.92–2.80)	–	–
50–69	–	–	12.0	1 (reference)	–	–
≥70	–	–	–	–	–	–
Education (years)						
<4	29.1	0.50 (0.09–2.79)	26.2	4.27 (1.67–10.89)	47.5	2.32 (0.50–10.69)
4–5	45.3	1.38 (0.67–2.85)	9.3	1.18 (0.49–2.84)	45.6	2.12 (0.46–9.84)
6–8	55.7	1.51 (0.77–2.93)	6.4	0.70 (0.21–2.29)	29.7	0.93 (0.10–8.59)
9–11	40.1	0.86 (0.41–1.82)	13.6	1.71 (0.50–5.89)	14.0	0.35 (0.05–2.30)
12[b]	48.0	1.01 (0.50–2.04)	6.1	0.64 (0.17–2.52)	34.1	1.21 (0.15–10.09)
>12[c]	43.1	1 (reference)	8.8	1 (reference)	29.8	1 (reference)
Marital status						
Single	61.9	1 (reference)	27.2	1 (reference)	66.0	1 (reference)
Married[d]	44.1	0. 58 (0.29–1.15)	9.9	0.34 (0.16–0.76)	38.0	0.29 (0.11–0.73)
Divorced/separated	49.4	0.68 (0.27–1.73)	9.0	0.32 (0.10–0.99)	41.8	0.54 (0.11–2.72)
Widowed	50.8	1.90 (0.21–17.5)	18.9	0.57 (0.22–1.45)	46.5	0.32 (0.13–0.80)
Public health-care provider						
NHS only	48.7	1 (reference)	13.9	1 (reference)	46.2	1 (reference)
NHS and other subsystem	38.1	1.15 (0.56–2.34)	6.4	0.52 (0.24–1.13)	23.9	0.53 (0.20–1.40)
Private health insurance						
No	47.5	1 (reference)	12.9	1 (reference)	45.0	–
Yes	41.1	1.03 (0.52–2.04)	5.9	0.56 (0.18–1.80)	–[e]	–
Doctor appointment (previous 3 months)						
No appointment	52.7	1 (reference)	24.5	1 (reference)	62.0	1 (reference)
Yes (routine)	39.1	0.39 (0.19–0.81)	3.0	0.11 (0.06–0.22)	34.7	0.23 (0.07–0.74)
Yes (due to a medical condition)	41.9	0.54 (0.33–0.89)	7.5	0.20 (0.12–0.32)	38.7	0.35 (0.21–0.58)
Cervical cytology screening						
Never	77.3	1 (reference)	35.0	1 (reference)	59.6	1 (reference)
Yes (at least once)	40.3	0.13 (0.07–0.26)	2.8	0.05 (0.03–0.10)	13.3	0.11 (0.05–0.22)
Smoking status						
Never smoker	50.4	1 (reference)	12.6	1 (reference)	45.2	1 (reference)
Ex-smoker	40.0	0.78 (0.35–1.71)	9.0	0.98 (0.34–2.82)	12.2	0.44 (0.10–2.02)
Current smoker	39.2	0.74 (0.43–1.26)	13.4	1.35 (0.45–4.07)	5.2	0.12 (0.01–1.75)
BMI (kg/m^2)						
<18.5	44.9	0.70 (0.16–2.98)	16.9	1.34 (0.23–7.97)	80.2	6.68 (1.06–42.16)
18.5–24.9	52.3	1 (reference)	15.4	1 (reference)	39.8	1 (reference)
25.0–29.9	33.3	0.51 (0.31–0.83)	10.7	0.59 (0.34–1.01)	45.3	1.43 (0.83–2.46)
≥30	46.8	0.81 (0.43–1.54)	9.9	0.52 (0.29–0.92)	41.7	1.23 (0.64–2.35)

a: Age- and education-adjusted.
b: Also includes participants with >12 years of non-university education.
c: Includes all participants with university education.
d: Includes individuals who are legally married or cohabiting.
e: There were no observations in this group.

as well as those who had a doctor appointment in the previous 3 months, either by routine (OR = 0.29, 95% CI: 0.10–0.86) or owing to a medical condition (OR = 0.51, 95% CI: 0.30–0.87), and those who underwent a cervical cytology screening before (OR = 0.50, 95% CI: 0.30–0.85) (table 3).

Women aged ≥70 years

As observed among the women aged 45–69 years, a lower risk of screening mammography underuse was observed for those living in LVT (OR = 0.40, 95% CI: 0.17–0.94), Alentejo (OR = 0.42, 95% CI: 0.16-1.07) and Madeira (OR = 0.31, 95% CI: 0.11–0.83). A previous cervical cytology screening was also negatively associated with underuse in this age-group (OR = 0.53, 95% CI: 0.29–0.98).

Obesity was associated with a lower risk of screening mammography underuse (OR = 0.25, 95% CI: 0.10–0.62) and underweight with a higher risk (OR = 6.53, 95% CI: 0.94–45.24) (table 3).

Women aged 30–44 years

In this age-group, married and divorced women were significantly more likely to undergo screening mammographies less often than the single. Women living in the Região Autónoma da Madeira were

Table 3 Determinants of screening mammography underuse (more recent mammography performed >2 years before) among women reporting having undergone a screening mammography before

	Women who underwent the more recent mammography >2 years before[a]					
	Women aged 30–44		Women aged 45–69		Women aged ≥70	
	%	Adjusted[b] OR (95% CI)	%	Adjusted[b] OR (95% CI)	%	Adjusted[b] OR (95% CI)
Region of residence (NUTS II)						
Norte	28.7	1.14 (0.49–2.67)	14.0	0.77 (0.40–1.46)	59.4	0.87 (0.38–1.98)
Centro	25.5	1 (reference)	17.0	1 (reference)	64.4	1 (reference)
LVT	19.8	0.76 (0.32–1.83)	10.6	0.56 (0.27–1.15)	46.9	0.40 (0.17–0.94)
Alentejo	34.0	1.56 (0.63–3.89)	12.6	0.59 (0.30–1.16)	42.2	0.42 (0.16–1.07)
Algarve	26.3	1.14 (0.47–2.75)	24.9	1.70 (0.87–3.32)	57.0	0.76 (0.29–1.98)
R.A. Açores	24.7	0.92 (0.36–2.34)	25.7	1.76 (0.89–3.49)	54.9	0.83 (0.27–2.53)
R.A. Madeira	8.7	0.21 (0.05–0.82)	8.3	0.48 (0.21–1.09)	32.5	0.31 (0.11–0.83)
Age (years)						
30–39	29.7	1 (reference)	–	–		–
40–44	21.4	0.70 (0.36–1.37)	–	–	–	–
45–49	–	–	9.8	0.72 (0.39–1.32)	–	–
50–69	–	–	14.5	1 (reference)	–	–
≥70	–		–	–	53.5	–
Education (years)						
<4	50.5	3.73 (0.52–26.74)	21.0	1.85 (0.65–5.30)	50.9	2.28 (0.28–18.81)
4–5	24.4	1.21 (0.41–3.57)	12.0	0.97 (0.37–2.56)	57.5	2.98 (0.35–25.37)
6–8	29.4	1.50 (0.50–4.51)	6.9	0.56 (0.14–2.19)	52.2	2.57 (0.18–36.08)
9–11	22.2	1.02 (0.32–3.30)	20.7	1.93 (0.59–6.29)	60.4	2.41 (0.21–27.83)
12[c]	22.7	1.02 (0.32–3.27)	9.7	0.84 (0.23–3.02)	49.2	1.60 (0.09–27.54)
>12[d]	21.5	1 (reference)	11.7	1 (reference)	27.7	1 (reference)
Marital status						
Single	13.7	1 (reference)	13.2	1 (reference)	52.5	1 (reference)
Married[e]	25.5	2.32 (0.69–7.76)	11.7	1.06 (0.38–2.97)	46.4	0.56 (0.12–2.55)
Divorced/separated	31.1	3.68 (0.76–17.73)	20.8	2.13 (0.59–7.65)	37.3	0.52 (0.05–5.92)
Widowed	5.5	0.57 (0.03–12.31)	21.3	1.66 (0.53–5.21)	60.8	0.69 (0.15–3.18)
Public health-care provider						
NHS only	28.9	1 (reference)	14.3	1 (reference)	53.4	1 (reference)
NHS and other subsystem	10.5	0.30 (0.10–0.85)	10.8	0.71 (0.36–1.40)	54.1	1.12 (0.38–3.34)
Private health Insurance						
No	26.9	1 (reference)	14.4	1 (reference)	53.4	1 (reference)
Yes	12.3	0.42 (0.15–1.19)	2.8	0.16 (0.04–0.65)	54.4	1.55 (0.16–14.9)
Doctor appointment (previous 3 months)						
No appointment	27.4	1 (reference)	18.2	1 (reference)	63.8	1 (reference)
Yes (routine)	20.5	0.64 (0.22–1.89)	6.6	0.29 (0.10–0.86)	69.4	0.98 (0.26–3.66)
Yes (due to a medical condition)	23.6	0.77 (0.39–1.53)	12.6	0.51 (0.30–0.87)	49.8	0.58 (0.26–1.31)
Cervical cytology screening						
Never	41.2	1 (reference)	23.1	1 (reference)	63.5	1 (reference)
Yes (at least once)	23.5	0.47 (0.19–1.16)	10.8	0.50 (0.30–0.85)	44.0	0.53 (0.29–0.98)
Smoking status						
Never smoker	24.7	1 (reference)	12.8	1 (reference)	54.1	1 (reference)
Ex-smoker	23.8	1.08 (0.35–3.36)	17.1	1.75 (0.57–5.33)	43.6	1.08 (0.15–7.60)
Current smoker	25.3	1.15 (0.54–2.45)	18.6	2.02 (0.64–6.42)	–[f]	–
BMI (kg/m^2)						
<18.5	57.0	3.44 (0.11–106.84)	12.1	0.70 (0.10–4.89)	90.3	6.53 (0.94–45.24)
18.5–24.9	24.0	1 (reference)	12.8	1 (reference)	66.1	1 (reference)
25.0–29.9	27.7	1.26 (0.61–2.61)	12.9	0.94 (0.53–1.68)	52.5	0.51 (0.26–1.04)
≥30	17.2	0.57 (0.18–1.79)	15.6	1.31 (0.69–2.49)	28.3	0.25 (0.10–0.62)

a: The present analysis includes only women who underwent a screening mammography before.
b: Age- and education-adjusted.
c: Also includes participants with >12 years of non-university education.
d: Includes all participants with university education.
e: Includes individuals who are legally married or cohabiting.
f: There were no observations in this group.

less likely to have undergone a screening mammography >2 years before (OR = 0.21, 95% CI: 0.05–0.82), as well as those covered by a National Health Service subsystem (OR = 0.30, 95% CI: 0.10–0.85) (table 3).

Discussion

Nine of 10 women at an eligible age for breast cancer screening have undergone a mammography before, as part of preventive care. However, nearly one-third of the younger women, for whom screening is not recommended, also reported a previous use of mammography screening. Most women aged 45–69 years underwent their latest mammography testing in the previous 2 years. Both the use and the underuse of this type of preventive care among eligible women varied widely across the country and with socio-demographic characteristics and access and use of health-care services.

These results are largely dependent on the local specificities of the Portuguese health system, as well as the demographic and epidemiological characteristics of the country, which limits the

generalizability of the findings to other settings. Nevertheless, this study evaluated a large representative sample of Portuguese women and provides information for understanding the relation between the national health policy for cancer screening and the use of screening mammography. Other limitations also need to be acknowledged for a proper interpretation of the findings.

The data for the present analysis were self-reported, and therefore, it is not possible to ensure that all the reports referred to screening mammographies. The potential overestimation of mammography use for screening purposes due to the reporting of diagnostic mammograms is expectedly minor and may have been further minimized, as the questions on this topic were part of a section referring specifically to preventive care. However, the question that assessed mammography use referred to this examination using the terms 'mamografia' (mammography) and 'radiografia ao peito' (chest radiography). In the Portuguese language, the latter may be interpreted as breast or chest radiography, which may have contributed to the high proportion of women aged 30–39 years who reported having undergone a mammography, despite screening not being recommended at this age. The overestimation of the use of mammography testing should have been much lower among the women aged >45 years, eligible for screening, and the interpretation of the prevalence estimates in this age-group is not expected to be compromised by the lack of specificity of the instrument of data collection. We may use our results to support the validity of these assumptions. For example, the region Centro is covered by organized screening, for women aged 45–69 years, since the 1990s,[6,12] and the participation rate in the most recent years was 69%.[7] This is compatible with our estimates of the life prevalence of screening mammography (82.8%) and the proportion of women having undergone it in the previous 2 years (83.0%). In Algarve, our estimates for mammography testing during life and for the proportion of screened women having undergone a mammography in the previous 2 years are 72.2% and 75.1%, respectively. In this region, the organized screening started only in 2005, and only 58% of the women invited in 2008–10 participated.[13] In Norte, only 12.5% of the eligible population was covered in 2009, with a participation rate of 60.6%,[14] and the high life prevalence of mammography use estimated in our study may be interpreted as the result of a quantitatively important overestimation. However, this is a heterogeneous region that includes the large urban area of Porto, where access to opportunistic screening is expectedly high,[15] and may result in a large proportion of the population being screened, even in the absence of organized screening. According to the Regional Health Administration of Norte (ARS Norte), in 2009, 54% of the women, with eligible age for screening, using the primary health-care centres had undergone a mammography.[14] This is further supported by the available data on the cervical cancer screening obtained in Porto, where no organized programme was available, that showed a life prevalence of cervical cytology use >90%, and a large proportion of women being tested annually.[16]

In the Região Autónoma da Madeira, breast cancer screening started in 1999, and in 2004–05 (third round of screening), the participation rate was 60%. In the Alentejo region, organized screening started in 2002, and by 2006, not all districts were covered. In the region of Lisboa e Vale do Tejo, organized breast screening started to operate in 2002, and by 2006, the coverage was still low. In the region of Algarve, organized screening started only in 2005,[17] and in the Região Autónoma dos Açores, it started in 2009.

This shows that the existence of a screening programme does not necessarily correspond to a higher proportion of women undergoing screening mammography, as opportunistic screening may be frequent and the programmes did not reach all the eligible women, owing to insufficient coverage and/or participation.

To disentangle the contribution of opportunistic screening and screening programmes for the overall mammography use, we would need to distinguish between examinations performed opportunistically and those conducted within organized screening. Unfortunately, no such information is available, and thus, no further discussion of this issue is possible.

The results show a less frequent utilization of screening mammography by women aged >70 years than by those aged 45–69 years. This reflects a higher proportion of older women never having undergone a mammography and recall bias,[18] which is more likely to occur as age increases.

Our results are in accordance with previous studies that showed significant associations between mammography use and factors related with education,[19–22] access to health-care services[20,22–24] and preventive care.[23,25,26] The less frequent reporting of mammography use by the less educated women could be mediated by factors such as lower access to health information,[27,28] lower adherence to organized screening[21] or recall bias.[19] The regular contact with primary health-care physicians has been positively associated with mammography screening[24,29] and within the recommended time frames.[26] Moreover, having private health insurance and having undergone a cervical cytology before was associated with a lower risk of non-use and underuse of breast cancer screening. Although women who engage in preventive activities are more likely to undergo a screening programme,[25] our results confirmed that a potentially easier access to health care, through public subsystems or private health insurance, is associated with a lower risk of not being screened. Recent interaction with the usual health-care provider increased the odds of having a mammography in the previous 2 years.

Previous studies have associated smoking with lower frequency of screening,[22,26] whereas overweight/obesity has been associated with lower,[30] equal[20,31] or higher[32] risk of screening. We did not observe differences according to smoking status, but obese women were less likely to have never undergone a mammography, which is relevant because obesity is a risk factor for breast cancer.[33]

Although opportunistic screening may attract more subjects having higher education levels,[34] and organized programmes are expected to cover proportionally more women of more disadvantaged social classes,[35] in our study, there were no significant differences between the regions with full coverage by organized screening (Centro and Autonomous Region of Madeira) and those with only partial or no coverage (data not shown). This may be explained by the fact that the participation in screening in Centro and in the Autonomous Region of Madeira was <70%, that most regions had already a partial coverage of screening in 2005–06 and/or that the life prevalence of mammography use was high in most settings.

In conclusion, both the risk of never having undergone a mammography and its underuse varied widely across the country and with socio-demographic characteristics and health-care utilization, depicting inequalities in the use of mammography screening. This study provides useful information to improve the allocation of resources to breast cancer screening.

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Conflicts of interest: None declared.

Key points

- Most women with an eligible age for breast cancer screening underwent a mammography before, and most of them were tested in the previous 2 years.

- Less educated and single women were less likely to have not been screened for breast cancer before.
- Women with private health insurance and those who had undergone a cervical cytology before were at lower risk of breast cancer screening underuse.
- This study provides useful information to improve the allocation of resources to breast cancer screening.

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